Wilkes University Curriculum Committee

PROPOSAL SUBMITTAL FORM

Directions:

- Use this set of forms for all proposals sent to the Curriculum Committee.
- Pages 1-3 of this document are required. Any unnecessary forms should be deleted from the packet before submissions. If multiple forms are needed (course addition, course deletion, etc), simply copy and paste additional forms into this packet.
- Note that all new programs (majors and minors), program eliminations, significant program revisions and all general education core revisions must be reviewed and approved by the Provost and Academic Planning Committee (APC) prior to submission to the Curriculum Committee. The Provost will make the decision if a program revision requires APC review.
- Completed and signed forms are due no later than the second Tuesday of every month. Submit one signed original hard copy and a scanned electronic copy with all signatures to the Chair of the Curriculum Committee.

1. Originator: Dr. Sid P. Halsor  
   Environmental Engineering and Earth Sciences Department  
   ph: 408-4611; email: sid.halsor@wilkes.edu

2. Proposal Title: B.S. Program in Geology

3. Check only one type of proposal: (double click on the appropriate check box and change default value to “checked”).
   - ☒ New Program. (Major or Minor Degree Programs). This requires prior review and approval by the Provost and APC.
   - ☐ Elimination of Program. (Major or Minor Degree Programs). This requires prior review and approval by the Provost and APC.
   - ☐ Program Revision. Significant revisions to a program require review and approval by the Provost. The Provost determines if review and approval by APC is necessary.
   - ☐ General Education Revision. Submissions only accepted from the General Education Committee (GEC). Must be reviewed and approved by the Provost.
   - ☐ Creation of new departments, elimination of existing department. This requires prior review and approval by the Provost and APC.
   - ☐ Course additions or deletions not affecting programs (such as elective courses, transition of “topics” courses to permanent courses).
   - ☐ Change in course credit or classroom hours.
   - ☐ Incidental Changes. Includes changes in course/program title, course descriptions, and course prerequisites. (Although these changes do require approval by the Curriculum Committee, they do not go before the full faculty for approval).
   - ☐ Other (Specify)
4. Indicate the number of course modification forms that apply to this proposal:

- 17 - Course Addition Form (plus syllabi)
- 3 - Course Deletion Form
- 3 - Course Change Form

5. Executive Summary of Proposal.

Briefly summarize this proposal. The breadth and depth of this executive summary should reflect the complexity and significance of the proposal. Include an overview of the proposal, background and reasoning behind the proposal and a description of how the proposal relates to the mission and strategic long-range plan of the unit and/or university. For incidental changes a one or two sentence explanation is adequate.

The proposed geology program is designed to fulfill traditional subject areas while having sufficient flexibility to include new or emerging trends in geoscience education and industry. The overarching goal is to prepare students for competitive participation in a range of geological career paths including industry (consulting and corporate), government agencies (state and federal) and academia (post-graduate research and teaching).

The distribution of credits in the proposed program is as follows:

<table>
<thead>
<tr>
<th>Credits Level</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total credits</td>
<td>127</td>
</tr>
<tr>
<td>Program requirements</td>
<td>50</td>
</tr>
<tr>
<td>Geology requirements</td>
<td>44</td>
</tr>
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<td>Distribution requirements</td>
<td>18</td>
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<td>Program electives</td>
<td>9</td>
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<td>Free electives</td>
<td>6</td>
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</table>

One of the governing factors in developing the curriculum is professional licensure. The state of Pennsylvania requires practicing geologists to be licensed professionals. One of the requirements for the “PG” (licensed Professional Geologist) is a degree within the geosciences that includes a minimum of 30 semester credits of geologic coursework (our current Earth and Environmental Sciences (EES) program has 8, geology minor requires 18). Our proposed program requires 44, excluding 9 program elective credits. Our additional 14 credits cover senior capstone research project and targeted subject areas (such as mineral and energy resources, geologic hazards and applied geophysics) that enhance the market value of graduates seeking entry-level positions in industry. Industrial sectors are more likely to invest in graduates that can earn the PG and have comprehensive geologic training in areas that serve their needs.

The proposed Geology program includes 9 elective credits. These credits can be fulfilled by courses that either bridge, broaden, or advance topic areas in geology. For instance, a geology major could take existing courses in water quality or soils (“bridge”), or courses in engineering geology or National Park geology (“broaden”) or courses in paleoclimatology or paleontology (“advance”). The curriculum is designed to maximize flexibility while maintaining rigor. For example, program and free electives can be used to pursue the Energy minor (note one geology major required course, GEO 206 qualifies for the Energy minor).
Another governing factor in the proposed curriculum is to maximize alignment with existing environmental engineering (ENV) and EES programs. When compared to the EES program, there are 54 credits of identical course credit including complete replication in the first and second semesters. On the ENV side, there are 27 identical credits and the proposed geology curriculum maintains the same semester offering for EES 211 Physical Geology and EES 240 Principles of Environmental Engineering and Science. Alignment of courses reduces disruption in existing programs and in the transition period to the new major.

Wilkes University has been the leader in earth science education in northeast Pennsylvania since the Department’s inception in the late 1960s. The earth sciences have always figured prominently in the EES program and serve to impart a distinguishing emphasis compared to many environmental science programs at other colleges and universities. The proposed Geology major will fortify Wilkes as a regional leader in earth science and forward the University’s commitment to academic excellence by attracting, educating and training students for 21st century careers in geoscience.

6. Other specific information. (Not applicable for incidental changes.)

What other programs, if any, will be affected by this proposal? Describe what resources are available for this proposal. Are they adequate? What would be the effect on the curriculum of all potentially affected programs if this proposal were adopted? Include any potential effects to the curriculum of current programs, departments and courses.

As mentioned above, the proposed Geology curriculum parallels the Earth and Environmental Sciences program in several key areas. The first two semesters are identical and over half of the second year course credits are shared. Two courses in geospatial technology (EES 271 and EES 272), a distinguishing strength in our existing programs, are preserved in the Geology curriculum in the third year. The gateway courses to our senior capstone experience, EES 302 and EES 304 are retained in the sixth semester of the Geology program. Our Department’s long-standing, comprehensive, senior projects I and II courses serve as the model for the Geology program.

The alignment of the two programs provides flexibility and a fluid transition into the new program while minimizing disruption of the EES program. It is the intent of the Department to offer both programs as the Geology program ramps up, faculty replacement positions are filled, marketing and promotional events get underway, and the longer term viability of EES program is assessed. An important advantage of this new program proposal is that it can be delivered while not impacting the EES program in a major way. This gives the Department more time to evaluate whether the Geology program impacts negatively or positively on the EES program.

Additional resources including lab equipment, software and supplies will be required to deliver the program. However, since the EEES Department has offered a Geology Minor for over 20 years a substantial amount of resources are already in place. This includes a new X-Ray Diffractometer ($85K) acquired through a grant award for mineral analysis, a research-grade and 10 student-grade petrographic microscopes acquired through an NSF equipment grant, a thin section system, two trim saws and a pulverizer for rock and mineral preparation, a sieve shaker and wide assortment of sieves for sediment analysis, comprehensive rock and mineral specimens for laboratory study, printed topographic and geologic maps, and field equipment (mapping-grade GPS devices, Brunton compasses, rock hammers, hand lenses, sample bags and safety vests). The Department also has a
GIS lab (Geographic Information Systems) that includes software and an extensive inventory of digital maps and imagery. The Department has two field vehicles to support field trips.

It is anticipated that after the program’s second year when students will be enrolling in the new upper level geology courses, including the summer geology field camp, that additional equipment (geophysical, geochemical hydrogeological and field) and software will be required. New courses/labs will require supplies, such as assorted glassware and reagents, additional sieves, structure and stratigraphic models, geologic maps, additional digital maps and imagery, instructional videos, and geological materials (rock, mineral, sand, silt, clay).

7. Program Outline. (Not applicable for incidental changes).

A semester-by-semester program outline as it would appear in the bulletin for a new program or any modified program with all changes clearly indicated.

The Geology major curriculum is designed to accomplish four objectives: 1) meet subject coverage of a traditional undergraduate program and the professional geology license, 2) achieve sufficient breadth to include secondary subjects that respond to contemporary trends in industry, 3) obtain distinction that distinguishes this program from other undergraduate programs in our region, and 4) parallel existing programs in Earth and Environmental Sciences (EES) and Environmental Engineering (ENV).

In addressing objective one, the curriculum includes core lecture/lab courses in mineralogy and petrology (GEO 281 and 282), stratigraphy and sedimentation (GEO 345), structure and tectonics (GEO 349) and field geology (GEO 380). These four content areas form the hub of many undergraduate geology programs. Built on the core areas are specialized courses that expand the knowledge base and include hydrogeology (GEO 352), geomorphology (GEO 370) and geochemistry (GEO 383). Objective two is accomplished through the inclusion of subject areas such as mineral and energy resources (GEO 206), digital mapping (EES 271 and EES 272), geologic hazards (GEO 375) and applied geophysics (GEO 390). Objective three is the blend of traditional and applied aspects of geology (objectives one and two) combined with a summer field geology course and capstone research experience that collectively, distinguishes our highly integrated program from regionally competing programs. Objective four allows flexibility between programs by achieving 60 and 30 shared credits between the Geology curriculum and the EES and ENV programs, respectively.

The Geology curriculum has a total of 127 credits. Required Geology courses comprise 44 credits and non-Geology course requirements total 50 credits. There are 18 distribution credits (Areas I,III,IV), 9 program elective credits and 6 free elective credits. Program requirements include two semesters of calculus, chemistry, physics and one semester of computer science. A minor in Energy or a certificate in Sustainability Management can be accomplished through program and free electives.
## Proposed Geology curriculum, semester by semester

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<td>CHM 113 Elements and Compounds Lab</td>
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<td>CHM 114 The Chemical Reaction Lab</td>
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<td>ENG 101 Composition</td>
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<td>GEO 211 Physical Geology</td>
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<td>FYF 101 First Year Foundation</td>
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<td>MTH 112 Calculus II</td>
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<td>MTH 111 Calculus I</td>
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<td>PHY 171 Principles of Classical and Modern Physics</td>
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<td>PHY 174 Applications of Classical and Modern Physics</td>
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<td>MTH 150 Elementary Statistics</td>
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<td>CS 115 Computers and Applications</td>
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<td>GEO 212 Historical Geology</td>
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<td>EES 240 Principles of Environmental Engineering and Science</td>
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<td>GEO 281 Mineralogy</td>
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<td>GEO 206 Solid Earth Energy and Mineral Resources</td>
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<td>GEO 282 Petrology</td>
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<tr>
<td>EES 271 Environmental Mapping I: GPS</td>
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<td>EES 272 Environmental Mapping II: GIS</td>
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<tr>
<td>GEO 345 Stratigraphy and Sedimentation</td>
<td>3</td>
<td>GEO 352 Hydrogeology</td>
<td>3</td>
</tr>
<tr>
<td>GEO 349 Structure and Tectonics</td>
<td>3</td>
<td>GEO 370 Geomorphology</td>
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<td>Program Elective</td>
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<td>EES 302 Literature Methods</td>
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<td>Distribution Requirement</td>
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<td>EES 304 Environmental Data Analysis</td>
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<td>GEO 383 Geochemistry</td>
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<td>GEO 390 Applied Geophysics</td>
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<tr>
<td>GEO 375 Geologic Hazards</td>
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<td>GEO 392 Senior Projects II</td>
<td>2</td>
</tr>
<tr>
<td>GEO 391 Senior Projects I</td>
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<td>Program Elective</td>
<td>3</td>
</tr>
<tr>
<td>Program Elective</td>
<td>3</td>
<td>Distribution Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Distribution Requirement</td>
<td>3</td>
<td>Free Elective</td>
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</tr>
<tr>
<td>Free Elective</td>
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<td></td>
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<tr>
<td><strong>Total Credits</strong></td>
<td>16</td>
<td><strong>Total Credits</strong></td>
<td>14</td>
</tr>
</tbody>
</table>

| Total Credits                       | 127     | Program electives options: existing courses |         |
| Geology Requirements                | 44      | GEO 351 Paleoecology                   |         |
| Program Requirements                | 50      | GEO 365 Introduction to Paleontology   |         |
| Distribution Requirements           | 18      |                                     |         |
| Program Electives                   | 9       | Program electives options: new courses |         |
| Free Electives                      | 6       | EES 210 Global Climate Change         |         |
|                                    |         | EES 230 Ocean Science                |         |
|                                    |         | ENV 315 Soils                        |         |
|                                    |         | ENV 330 Water Quality                |         |

### Proposed bulleted course descriptions:

**GEO 206 Solid Earth Energy and Mineral Resources**  
3 credits

The distribution in both space and time of fossil fuel (crude oil, natural gas and coal), nuclear fuel minerals, and geothermal sources in the earth's crust; the formation, accumulation and extraction of these energy resources, and historical, current and projected consumption trends. Additionally, the occurrences and formational processes of metal and non-metal deposits are examined in the context of plate tectonics, earth's
geologic history and energy flow. Three hours of lecture per week. Requirements: open to majors and non-majors. GEO 206 qualifies for the Energy Minor and is cross-listed with EGY 206.

**GEO 211 Physical Geology (formerly EES 211)**

4 credits

Description, analysis, and laboratory studies of earth materials, structure, and processes, including earth’s surface, interior, age, and origin. Three hours of lecture and three hours of lab per week. Requirements: For CS, Engineering, Math, and Science majors only.

**GEO 212 Historical Geology (formerly EES 212)**

3 credits

A study of the geologic record of the earth’s formation and evolution, including methods of dating. Two hours of lecture and three hours of lab per week. Pre-requisites: GES 211 or permission of instructor.

**GEO 281 Mineralogy (formerly EES 381)**

3 credits

The systematic study of the major classes of the mineral kingdom utilizing the department’s collection. Concepts in crystal chemistry, crystal structure, mineral behavior, crystallography and optical mineralogy are studied and advanced techniques in mineral analysis are used. Two hours of lecture and three hours of lab per week. Pre-Requisite: GEO 211 and CHM 115

**GEO 282 Petrology (formerly EES 382)**

3 credits

A study of the identification, classification, composition, genesis, and alteration of igneous, sedimentary, and metamorphic rocks and their relation to crustal processes and tectonic environments. Two hours of lecture and three hours of lab per week. Pre-requisite: GEO 281

**GEO 345 Stratigraphy and Sedimentation**

3 credits

The study of the formation and interpretation of sedimentary systems, from sediment grains to depositional basins. The course starts from the grain scale and moves up to basin and global scales. Two hours of lecture and three hours of lab per week. Pre-requisites: GEO 211 and GEO 212

**GEO 349 Structure and Tectonics**

3 credits

The study of rock deformational processes and resulting structures in the Earth’s crust with application to global and regional tectonics. Lab work and field trips emphasize the use of methods to assist in the geometric and kinematic interpretation of rock structures. Two hours of lecture and three hours of lab per week. Pre-requisites: GEO 281 and GEO 282

**GEO 352 Hydrogeology**

3 credits

An introduction to the study of groundwater: groundwater flow, well hydraulics, groundwater quality and pollution, and resource exploration, evaluation, and management. Lab activities use a mix of field, wet lab, computer and mapping skills. Two hours of lecture and three hours of lab per week. Pre-requisite: GEO 211

**GEO 370 Geomorphology (formerly EES 370)**

3 credits

Land forms, their evolution, and the human role in changing the surface of the earth, utilization of geologic and hydrologic information, and field investigations. Two hours of lecture and three hours of lab per week. Pre-requisite: GEO 211

**GEO 375 Geologic Hazards (formerly EES 298)**

3 credits

This course examines geologic processes that are a natural consequence of plate tectonics and hazardous to life and property. After establishing a framework for geologic hazards study, principle geologic hazards will be investigated. Emphasis will be placed on current scientific understanding, event frequency, forecasting and monitoring and mitigation. Several case studies will be included. Three hours of lecture per week. Pre-requisite GEO 211 and GEO 212
GEO 380 Geology Field Camp
A four-week summer field course designed to train students in traditional and modern methods of geologic investigations. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections and construct geologic maps and cross sections. Field locations may range from local/regional to western U.S. depending on course emphasis and resources. Pre-requisites: GEO 281, GEO 282, GEO 345, GEO 349 and GEO 352.

GEO 383 Geochemistry
Application of chemistry to study the distribution and cycling of elements in the crust of the earth. Includes chemical bonding and crystallization, phase rules and phase diagrams, chemical equilibria, radiogenic and stable isotopes and origin of elements. Geochemical environments of study include low-temperature aqueous solutions and high-temperature magmatic systems. Two hours of lecture and three hours of lab per week. Pre-requisites: CHM 115, CHM 116, GEO 211, GEO 281, GEO 282

GEO 390 Applied Geophysics
An introduction to the application of geophysical methods to geological and environmental investigations. Topics include fundamentals of geophysics and hands-on instrument training and measurement. Instruments may include ground penetrating radar, seismic reflection and refraction, electrical resistivity and electromagnetic induction. Two hours of lecture and three hours of lab per week. Pre-requisites: PHY 171, PYH 174, GEO 211

GEO 391 Senior Projects I
Design and development of selected research projects in geology under the direction of a faculty member. Capstone research deliverables include a proposal, detailed progress reports and a formal mid-year report. Requirements: Senior standing in Geology and department permission. (See the department for more details about the department permission.)

GEO 392 Senior Projects II
Second semester continuation of Senior Projects I. Capstone research deliverables include detailed progress reports, a professional-grade poster, a final written report, and a formal oral presentation of research project. Requirements: Senior standing in Geology and department permission. (See the department for more details about the department permission.) Pre-requisite: GEO 391

Geology Program Assessment and SLOs
The EEES Department has outcome assessment programs for its two B.S. degree programs: Environmental Engineering and Earth and Environmental Sciences. The outcome assessment program for the proposed Geology program will parallel these existing programs. Educational objectives for the Geology program frame the assessment strategy.

The B.S. in Geology will produce graduates who:
1. have scientific knowledge to analyze and solve geological problems
2. have received training that goes beyond the classroom and laboratory to include the “natural laboratory” or field where fundamental observations and measurements take place
3. have achieved the academic requirements to pursue professional licensure in geology
4. have good communication and computing skills that are required in successful professional practice
5. are prepared for employment at entry-level positions in industry or government agencies; and
6. are prepared for graduate studies leading to advanced degrees in geology and closely-related fields

Student Learning Outcomes:
Each graduate of the Geology program should be able to demonstrate:
1. an ability to function on multi-disciplinary teams
2. an ability to communicate effectively through oral presentations and written reports
3. an ability to design and conduct experiments, as well as analyze and interpret data through laboratory and field exercises
4. an ability to use modern techniques and skills necessary for practice in the geological field.

Student Learning Outcomes Measurement Method:
The senior research project is a degree requirement for all students pursuing the B.S. in Geology. Students will identify and develop a research proposal on an approved project in EES 302 during second-semester junior year. Students will conduct their research during their senior year in GES 391 and GES 392 (Senior Projects I & II) fall and spring semesters, respectively. The research project will require three deliverables by the end of the academic year: a project presentation for Department faculty and students, a professional-grade poster of their project, and a formal written document of their project. The written document goes through several review stages, including outside review by a technical editor. An internally developed faculty rubric is used to evaluate the project presentation and final report. Senior Projects I & II will be the culminating experiences of the BS in Geology program and will require comprehensive and integrated application of acquired skills and knowledge. Department faculty will use the rubric to generate data relevant to student achievement of the identified learning outcomes.

The Department recognizes the important role of program assessment in assuring that “we’re doing what we say we’re doing” and furthermore, providing a mechanism for continuous program improvement. Department faculty and staff will work together to identify and implement additional measurement methods as the Geology program solidifies its place in the University’s academic profile.
Wilkes University Curriculum Committee  
COURSE CHANGE FORM

**Directions**: Use this form to change information relating to an existing course. Please note, changes to course number require separate course addition/deletion forms (not this form!). Only indicate changes that are proposed (existing and proposed), other fields should be left blank.

**Course Number**: EES 211  
**Course Title**: Physical Geology

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<tr>
<th>Course Title</th>
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<tbody>
<tr>
<td>Course Credit hours. (Indicate classroom, lab or “other” hours.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Prerequisites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Description (as proposed for Bulletin)¹</td>
<td>Description, analysis, and laboratory studies of earth materials, structure, and processes, including earth’s surface, interior, age, and origin. Three hours of lecture and three hours of lab per week. Requirements: For CS, Engineering, Math, and Science majors only.</td>
<td>Description, analysis, and laboratory studies of earth materials, structure, and processes, including earth’s surface, interior, age, and origin. Three hours of lecture and three hours of lab per week. Requirements: For CS, Engineering, Math, and Science majors only. Cross-listed with GEO 211</td>
</tr>
</tbody>
</table>

¹ Course descriptions provide an overview of the topics covered. If the course is offered on a scheduled basis, i.e. every other year, or only during a set semester, note this in the description. Course descriptions should be no more than two to three sentences in length.
Wilkes University Curriculum Committee  
COURSE CHANGE FORM  

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<tr>
<th>Course Number:</th>
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<tbody>
<tr>
<td>Course Title:</td>
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<td>Course Title</td>
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</tr>
<tr>
<td>Course Credit hours. (Indicate classroom, lab or “other” hours.)</td>
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<td></td>
</tr>
<tr>
<td>Course Prerequisites</td>
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<td></td>
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<tr>
<td>Course Description (as proposed for Bulletin)(^1)</td>
<td>A study of the geologic record of the earth’s formation and evolution, including methods of dating. Two hours of lecture and three hours of lab per week.</td>
<td>A study of the geologic record of the earth’s formation and evolution, including methods of dating. Two hours of lecture and three hours of lab per week. Cross-listed with GEO 212.</td>
</tr>
</tbody>
</table>

\(^1\) Course descriptions provide an overview of the topics covered. If the course is offered on a scheduled basis, i.e. every other year, or only during a set semester, note this in the description. Course descriptions should be no more than two to three sentences in length.
Wilkes University Curriculum Committee

COURSE CHANGE FORM

Directions: Use this form to change information relating to an existing course. Please note, changes to course number require separate course addition/deletion forms (not this form!). Only indicate changes that are proposed (existing and proposed), other fields should be left blank.

Course Number: EES 370
Course Title: Geomorphology

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</tr>
<tr>
<td>Course Prerequisites</td>
<td></td>
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<tr>
<td>Course Description (as proposed for Bulletin)¹</td>
<td>Land forms, their evolution, and the human role in changing the surface of the earth, utilization of geologic and hydrologic information, and field investigations. Two hours of lecture and three hours of lab per week.</td>
<td>Land forms, their evolution, and the human role in changing the surface of the earth, utilization of geologic and hydrologic information, and field investigations. Two hours of lecture and three hours of lab per week. Cross-listed with GEO 370.</td>
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¹ Course descriptions provide an overview of the topics covered. If the course is offered on a scheduled basis, i.e. every other year, or only during a set semester, note this in the description. Course descriptions should be no more than two to three sentences in length.
1. Course Title: Solid Earth Energy and Mineral Resources

2. Course Number: GEO 206

3. Course Credit Hours: 3
   Classroom Hours ___3___  Lab Hours _____  Other ______

4. Course Prerequisites:

5. Course Description (as proposed for the Bulletin):

   The distribution in both space and time of fossil fuel (crude oil, natural gas and coal), nuclear fuel minerals, and geothermal sources in the earth’s crust; the formation, accumulation and extraction of these energy resources, and historical, current and projected consumption trends. Additionally, the occurrences and formational processes of metal and non-metal deposits are examined in the context of plate tectonics, earth’s geologic history and energy flow. Three hours of lecture per week. Requirements: open to majors and non-majors. GEO 206 qualifies for the Energy Minor and is cross-listed with EGY 206. Offered every spring semester.

GEO 206  **Solid Earth Energy and Mineral Resources** 3 credits

Lecture: 3hrs/week

Professor: Sid P. Halsor  
Office Location: CSC 406A  
Office Hours:  
e-mail: sid.halsor@wilkes.edu

Office Phone: 570-408-4611


I. Description

The distribution in both space and time of fossil fuel (crude oil, natural gas and coal), nuclear fuel minerals, and geothermal sources in the earth’s crust; the formation, accumulation and extraction of these energy resources, and historical, current and projected consumption trends. Additionally, the occurrences and formational processes of metal and non-metal deposits are examined in the context of plate tectonics, earth’s geologic history and energy flow. Three hours of lecture per week. Requirements: open to majors and non-majors. GEO 206 qualifies for the Energy Minor and is cross-listed with EGY 206.

II. Objectives

1) Describe the distinguishing events in earth’s geologic history and their effect on the formation of solid earth natural resources
2) Articulate the geologic factors that govern the inequitable global distribution of energy and mineral resources
3) Use knowledge to contrast the pace of resource formation and human utilization within the trajectory of geologic time
4) Explain the mechanisms that accumulate commercial quantities of crude oil and natural gas and understand the differences between conventional and non-conventional plays
5) Explain the origin and principle types of metal and non-metal mineral resources
6) Describe advances in technology that improve exploration strategies and reduce environmental impacts of resource extraction
7) Demonstrate command of the work and energy flow from raw material to commercial product
8) Describe the career opportunities in solid earth energy and mineral resources industries

III. Content delivery

Students will receive subject matter by way of:
- Presentations and handouts given by the course instructor
- Presentations given by guest lecturers
- The O’Hara textbook and online resources
- Field trips to local/regional energy and/or ore mineral extraction sites

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IV. Schedule of Topics

I. Course introduction:
   a. Overview and expectations
   b. Energy/minerals and science of geology
   c. Instructor’s professional experiences in topic

II. Hydrocarbon fuels
   a. Role in economic development
   b. The “haves and have nots”—global distribution
   c. Peak oil and future trends

III. Formation and accumulation of hydrocarbon fuels
   a. Sedimentary basins
   b. Maturation and fuel product
   c. Trapping mechanisms
   d. Reservoir and source rock
   e. Exploration techniques

IV. Geothermal energy
   a. National and global status
   b. Distribution
   c. Heat flow in rocks
   d. Wet vs dry systems
   e. Technology and future outlook

V. Nuclear energy
   a. Distribution and current trends
   b. Nature of fuel source
   c. Mechanisms for geologic deposits
   d. Extraction methods
   e. Modern power plant operation
   f. Future role in energy supply

VI. Earth mineral resources
   a. Distribution
   b. Metal ore deposits
   c. Nonmetals and industrial minerals
   d. Mineral exploration
   e. Mine development
   f. Energy flow
   g. Environmental impacts

V. Research project
A research project is required in this course. The instructor will present a list of topics but topics off-list can be proposed. A proposed topic requires the instructor’s approval. The findings of your research will be presented in the form of a summary paper and oral presentation. Guidelines for the research project will be distributed in the third week of the semester.

VI. Field trips
Our region includes active coal mining, shale gas development and nuclear power generation. Arrangements will be made to visit an example of each of these facilities over the course of the semester.

VII. Grading

<table>
<thead>
<tr>
<th>Grade-point distribution</th>
<th>points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research summary paper and presentation</td>
<td>100</td>
</tr>
<tr>
<td>2 midterm exams @ 100 pts</td>
<td>200</td>
</tr>
<tr>
<td>1 final exam</td>
<td>100</td>
</tr>
<tr>
<td>4 homework problems@25pts</td>
<td>100</td>
</tr>
<tr>
<td>Participation in field trips and small group discussions</td>
<td>100</td>
</tr>
</tbody>
</table>

*final grade is based on 600 total points*

VII. Attendance

It is the student's responsibility to inform the instructor of an upcoming excused absence from class as soon as possible. Make ups for absences will be at the discretion of the instructor. *There will be absolutely no make ups for unexcused absences.* You should strive to contact the instructor if circumstances arise that conflict with attending class; avoid contacting the instructor after any unexcused absence.

VII. Intellectual responsibility and plagiarism

Plagiarism and other forms of academic dishonesty will not be tolerated. Students engaging in misconduct or dishonest practices on exams, quizzes, or other assignments will be dealt with according to the guidelines established by the university. You must review the institution’s policies in the Student Handbook at:


VIII. Mobile phones

All communication devices must be in airplane or silent-mode when class starts. If your work situation requires that you be on call, please notify the instructor prior to class. Text messaging and photo-taking is not permitted in this class.

IV. Help Along the Way

Students who lack prior exposure to earth science may encounter some difficulty while learning important concepts and processes. Geology is a visual science and processing image and graphical information (not just viewing but analyzing) is critical to its understanding. Like all challenging endeavors, practice is the key to successful performance. If your “practice” sessions need help, I urge you to seek me out for assistance. Other means by which you can maximize your performance in this class include: attendance (don’t miss class), ask questions (to me or your peers) and keep pace with subject material (manage your time).

See you in class and best of luck!
Wilkes University Curriculum Committee
COURSE ADDITION FORM

7. Course Title: Physical Geology

8. Course Number: GEO 211

9. Course Credit Hours: 4
   Classroom Hours ___3___   Lab Hours ___4___   Other ___

10. Course Prerequisites: For CS, Engineering, Math, and Science majors only

11. Course Description (as proposed for the Bulletin):

   Description, analysis, and laboratory studies of earth materials, structure, and processes, including earth’s surface, interior, age, and origin. Three hours of lecture and three hours of lab per week. Requirements: For CS, Engineering, Math, and Science majors only

12. Required Documentation: Syllabus attached
GEO 211  Physical Geology  4 credits

Lecture:  3 hrs/week
Laboratory:  3 hrs/week

Professor:  Sid P. Halsor  (sid.halsor@wilkes.edu)  Office Location:  CSC 417
Office Hours:  Office Phone: 570-408-4611


--- Course info and lecture slides available via "My Courses" on Wilkes portal ---

I. Course Overview

   The central goal of GEO 211 is to learn the fundamental processes in the earth system
   and how these processes continuously drive planetary change over varying time scales.
   Students will learn the physical workings of the planet by studying its various parts (geologic
   materials, features), how these parts are interconnected (linking processes), and the time scales
   in which the earth undergoes physical change (geologic time). The dynamic nature of earth is
   taught within the context of two energy systems: 1) the external energy system which drives
   surface processes and is powered by the sun; and 2) the internal energy system which drives
   the movement of continents and is powered by earth’s internal heat. Subject material is
   addressed through a combination of slide/internet lecture presentations, textbook readings,
   independent research, and hands-on laboratory exercises.

II. Course Objectives

1) To discuss the integrative nature of the science of geology and its dependence on principles
   in biology, chemistry, physics and mathematics.
2) To compare and contrast the major geologic characteristics of earth and its planetary
  neighbors and describe how interplanetary exploration contributes to geologic discovery.
3) To explain how materials and energy are stored in the earth system and how they are cycled
   among the principal reservoirs (lithosphere, hydrosphere, atmosphere, biosphere).
4) To discuss the concept of geologic time including the principles that underlie the geologic
   time scale and the physical development of earth through time.
5) To explain geologic hazards and processes of rock formation, alteration, and decomposition
   within the framework of plate tectonics.
6) To demonstrate the important role of field-based observation and measurement to the
   science of geology.
7) To identify and describe processes that shape the earth’s surface and the role of human
   activity in influencing those processes.
8) To examine and evaluate the relations between chemical and physical properties in
   common rocks and minerals.
9) To explain the geologic occurrences of mineral and energy resources and the relations
   between resource utilization, economic development and environmental degradation.
10) To utilize GIS technology in the integration of spatial data (topographic and geologic
    maps) and geological analysis.

III. Schedule of Topics and Exams
<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Topic</th>
<th>Chapters in Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 18 – Feb 26</td>
<td>1-6</td>
<td>Geology and Earth’s Materials</td>
<td>1-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ nature and objectives of the science</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ geologic investigations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ earth's distinguishing characteristics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ plate tectonics and the rock cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ minerals (silicates and non-silicates)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ rocks (igneous, sedimentary, metamorphic)</td>
<td></td>
</tr>
<tr>
<td>Feb 29 – Apr 1</td>
<td>7-10</td>
<td>Time and Surface Processes</td>
<td>9,13-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ geologic time</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>√ climate, weathering and erosion</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>√ streams and drainage systems</td>
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<td></td>
<td></td>
<td>√ groundwater</td>
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<tr>
<td></td>
<td></td>
<td>√ glaciers and glaciation</td>
<td></td>
</tr>
<tr>
<td>Apr 4 – May 4</td>
<td>11-15</td>
<td>Internal Processes and the Evolving Earth</td>
<td></td>
</tr>
<tr>
<td>8,11,12,18</td>
<td></td>
<td>√ rock deformation and mountain building</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ earthquakes and the earth's interior</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ energy and mineral resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>√ current issues in geosciences</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exam #1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Feb 19</td>
<td>Mar 23</td>
<td>Apr 20</td>
</tr>
</tbody>
</table>

IV. Research Project/Presentation
A formal presentation of a research project is required in this course and supports our Department’s program emphasis on critical thinking and effective communication. EEES faculty believe our students, as scientists and engineers in training, must be able to find relevant information, analyze it and convey conclusions about it. By practicing these essential tasks while delving into a specific topic in geology, you will engage a process that is an expectation of employers and graduate programs. The objective then is to sharpen your analytical and verbal skills in preparation for the professional career you choose to pursue after graduation.

V. Laboratory
Laboratory assignments are designed to be completed within the 3-hour laboratory period. A missed lab must be made up before the next scheduled lab convenes. It is **your** responsibility to arrange a make-up lab with the instructor.

<table>
<thead>
<tr>
<th>Lab Dates (Chap)</th>
<th>Topic</th>
<th>Quiz</th>
<th>Lab Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 21</td>
<td>Plate Tectonics</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Jan 28</td>
<td>Mineral Analysis I</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Feb 4</td>
<td>Mineral Analysis II</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feb 11</td>
<td>Igneous Rocks</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feb 18</td>
<td>Sedimentary Rocks</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Feb 25</td>
<td>Metamorphic Rocks</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>Mar 3</strong></td>
<td><strong>Lab Exam 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mar 10</strong></td>
<td><strong>Spring Recess</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar 17</td>
<td>Maps</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

18
Mar 24
Mar 31
Apr 7
Apr 14
Apr 21
Apr 28
May 3
-
- Holiday Recess - -

Structures and Geologic Maps 6 10
Field Trip: 7 Tubs Nature Area 7
Geologic Mapping Using GIS 8
Streams and Rivers 9 11
Groundwater 12
Lab exam 2

VII. Grade-point distribution  final grade is based on 900 total points

<table>
<thead>
<tr>
<th>lecture (55% of total)</th>
<th>points</th>
<th>laboratory (45% of total)</th>
<th>points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project/Presentation</td>
<td>100</td>
<td>9 quizzes (lowest score omitted) @ 10 pts</td>
<td>80</td>
</tr>
<tr>
<td>2 midterm exams @ 100 pts</td>
<td>200</td>
<td>2 laboratory exams @ 100 pts</td>
<td>200</td>
</tr>
<tr>
<td>1 final exam</td>
<td>100</td>
<td>12 laboratory exercises @ 10 pts</td>
<td>120</td>
</tr>
<tr>
<td>4 homework problems @ 25 pts</td>
<td>100</td>
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<td></td>
</tr>
</tbody>
</table>

*Text: Exploring Geology*, by Reynolds, Johnson, Kelly, Morin, and Carter, 4th edition. This is a unique textbook designed to help you learn geologic concepts and processes on your own and to complement what we do in class. *My desire is to include textbook resources that facilitate learning in an incremental manner so textbook-based homework assignments will be administered as I deem appropriate.* Nearly all the information in the book is built around illustrations and photographs, rather than being in long blocks of text. The entire book consists of a series of two-page spreads organized into chapters. Each two-page spread is a self-contained block of information about a specific topic, and has a short list indicating what you should be able to do before you leave these pages. The items from these lists are compiled into a What-To-Know List that is downloadable from this course’s Blackboard website. The What-To-Know List is your guide to what is important when studying from the textbook. Required reading is listed in the right column of the Schedule of Topics and Exams on pp.1-2 in this document. If you revisit the chapter corresponding to the most recently finished lecture after we cover that topic, the material will be best retained. Each two-page spread in the book has a unique number (e.g., 12.4), and these numbers are referenced for any online quizzes and other course assignments that may be administered. Each chapter ends with an investigation concerning a problem associated with a “virtual place”. These investigations may be assigned as homework.

**Attendance:** Each student is expected to attend all classes and lab sessions. It is the student's responsibility to inform the instructor of an excused absence as soon as possible. Absences for emergency situations may be excused unofficially by the instructor. Instructor-excused absences must be obtained prior to or on the day of the student's absence. It is the student's responsibility to inform the instructor of an upcoming excused absence as soon as possible. Make ups for such absences will be at the option of the instructor. *There will be absolutely no make ups for unexcused absences.* Please contact the instructor if you have circumstances arise that conflict with attending class. Please do not contact the instructor after any unexcused absence (re-read this paragraph if necessary).

**Field Trips:** Geology is best seen, learned, and taught outdoors. During the semester, at least one of the lab sessions will be used for a local field trip. In addition, I will notify you of any scheduled voluntary field trips outside of this course that could enhance your geology experience.
13. Course Title: Historical Geology

14. Course Number: GEO 212

15. Course Credit Hours: 3
   Classroom Hours ___2___   Lab Hours ___3___   Other _____

16. Course Prerequisites: GEO 211 or permission of instructor

17. Course Description (as proposed for the Bulletin):

   A study of the geologic record of the earth’s formation and evolution, including methods of dating. Two hours of lecture and three hours of lab per week.

18. Required Documentation: Syllabus attached
GEO 212 Historical Geology 3 credits  
Lecture: 2hrs/week; Lab: 3hrs/week

Instructor: Dr. Brian Redmond  
Office Hours: CSC 426   
Office Phone: 408-4698   
Home: 696-2906  
e-mail: brian.redmond@wilkes.edu


<table>
<thead>
<tr>
<th>Week</th>
<th>Text</th>
<th>Chapter</th>
<th>Pages</th>
<th>Lab Exercises</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>The Science of Historical Geology</td>
<td>1 - 12</td>
<td>1-1, 1-2, 1-4, 1-6</td>
<td>38-40, 44-45, 48-52</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Early Geologists Tackle History’s Mysteries</td>
<td>13 - 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Time and Geology</td>
<td>29 - 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Rocks &amp; Minerals: Documents that Record ...</td>
<td>49 - 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>The Sedimentary Archives</td>
<td>81 - 124</td>
<td>2-1 thru 2-3</td>
<td>70 - 78</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Life on Earth: What Do Fossils Reveal?</td>
<td>125 - 166</td>
<td>2-4 thru 2-11</td>
<td>79 - 91</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>Plate Tectonics Underlies All Earth History</td>
<td>167 - 212</td>
<td>3-1 thru 3-4</td>
<td>95 - 106</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>The Earth’s Formative Stages &amp; the Archean Eon</td>
<td>213 - 248</td>
<td>Lecture Exam 1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>The Proterozoic: Dawn of a More Modern World</td>
<td>249 - 272</td>
<td>3-5</td>
<td>112 - 121</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>Early Paleozoic Events</td>
<td>273 - 300</td>
<td>3-7 thru 3-11</td>
<td>123 - 141</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>Late Paleozoic Events</td>
<td>301 - 332</td>
<td>4-1 thru 4-7</td>
<td>152 - 156</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>Life of the Paleozoic</td>
<td>333 - 380</td>
<td>4-13 thru 4-16</td>
<td>199 - 211</td>
</tr>
<tr>
<td>10</td>
<td>13</td>
<td>Mesozoic Events</td>
<td>381 - 412</td>
<td>Lecture Exam 2</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>14</td>
<td>Life of the Mesozoic</td>
<td>413 - 464</td>
<td>5-1 thru 5-7</td>
<td>217 - 243</td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>Cenozoic Events</td>
<td>465 - 500</td>
<td>5-8</td>
<td>231 - 243</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>Life of the Cenozoic</td>
<td>501 - 538</td>
<td>6-1 thru 6-3</td>
<td>246 - 255</td>
</tr>
<tr>
<td>14</td>
<td>17</td>
<td>Human Origins</td>
<td>539 - 562</td>
<td>cleanup</td>
<td></td>
</tr>
</tbody>
</table>

There will be three open-book exams, mostly non-comprehensive, the last exam being held during Finals. The three combined exams will count for 60% of the final grade, the remaining 40% consisting of lab work. Lab work will consist of lab exercises, lab quizzes, and possible field work. It is the student’s responsibility to make-up an excused lab period. Make-ups should be completed prior to the following lab exercise. All late labs will be marked down 10% each week late.

Historical Geology is much more than the history of the science of geology - it is the systematic study of the geologic history of our planet Earth. In this context, geologists work much like historians, piecing together information from the geologic record in order to provide an account of the Earth’s formation and evolution. In contrast to Physical Geology (GES 211), which is primarily the study of earth materials and physical processes, Historical Geology focuses
on the utility of rocks and fossils in interpreting Earth's history. This course and GES 211 are the equivalent of the first year geology requirement of a geology major and cover, between them, the major sub-disciplines of geology.

**GEO 212 Historical Geology**

**Course Objectives**

1. To discuss the integrative nature of the science of geology and its dependence on principles in biology, chemistry, physics, and mathematics.

2. To explain how materials and energy are stored in the Earth system and how they are cycled among the principal reservoirs: lithosphere, hydrosphere, atmosphere, biosphere.

3. To identify and describe processes that shape the Earth's surface and the role of human activity in influencing these processes.

4. To recognize the characteristics of rocks, explain their origin, and discuss the significance of their formation in the structure of the crust of the Earth.

5. To be able to describe in detail what the internal structure of the Earth is, how it evolved, and how it has shaped the surface of the Earth with special attention paid to Plate Tectonics and hot spot activity with all of their associated processes and interactions.

6. To be able to describe those constructional and degradational processes which shape the surface of the Earth including erosion, mass wasting, land sliding, subsidence, and weathering.

7. To be able to reproduce the geologic time scale and explain why the time divisions are where they are; to be able to explain what relative and absolute dating are, and to be able to perform simple radiometric calculations to determine absolute ages.

8. To be able to explain the origin and development of the Earth through geologic time in detail with some comparisons with the other terrestrial planets.

9. To be able to discuss the origin of fossils and how these fossils are used to reconstruct the evolutionary history of life.

10. To be able to list and discuss the stratigraphic principles used to interpret life and earth history.

11. To be able to construct topographic and geologic maps and to use them to solve problems.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

19. Course Title: Mineralogy

20. Course Number: GEO 281

21. Course Credit Hours: 3
   Classroom Hours _2__  Lab Hours _3__  Other ______

22. Course Prerequisites: GEO 211 and CHM-115.

23. Course Description (as proposed for the Bulletin):

   The systematic study of the major classes of the mineral kingdom utilizing the department's
collection. Concepts in crystal chemistry, crystal structure, mineral behavior, crystallography and
optical mineralogy are studied and advanced techniques in mineral analysis are used. Two hours
of lecture and three hours of lab per week. Offered every fall semester.

GEO 281  Mineralogy  3 credits

Lecture: 2hrs/week  
Laboratory: 3 hrs/week

Professor: Sid P. Halsor  
Office Location: CSC 406A
Office Hours: M 11-12; W 9-10; R 10-11  
e-mail: sid.halsor@wilkes.edu
Office Phone: 570-408-4611


I. Course Objectives

EES 381 explores the science of mineralogy and the use of several advanced techniques in mineral analysis. Specifically, this course: 1) builds on the basics of mineralogy presented in physical geology (physical properties, chemical composition, genesis, identification and classification) through the systematic study of select mineral groups in the Department’s collection; 2) pursues a working understanding of the fundamental concepts of crystal chemistry, crystallography and optical mineralogy; 3) provides training on the use of the petrographic microscope in mineralogical studies; and 4) examines the health risk posed by certain hazardous minerals in our environment.

II. Schedule of Topics and Exams

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Chap.</th>
<th>Date</th>
<th>Lab Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/31</td>
<td>Introduction</td>
<td>1</td>
<td>9/3</td>
<td>Review physical properties</td>
</tr>
<tr>
<td>9/2</td>
<td>Physical Properties</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/7</td>
<td>Labor Day</td>
<td></td>
<td>9/10</td>
<td>Density measurement</td>
</tr>
<tr>
<td>9/9</td>
<td>Native Elements</td>
<td>15</td>
<td>9/17</td>
<td>Spectroscopic analysis</td>
</tr>
<tr>
<td>9/14</td>
<td>Crystal Chemistry</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/16</td>
<td>Sulfides</td>
<td>15</td>
<td>9/24</td>
<td>Atomic packing</td>
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<tr>
<td>9/21</td>
<td>Chemical Composition</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/23</td>
<td>Oxides</td>
<td>16</td>
<td>10/1</td>
<td>Symmetry elements</td>
</tr>
<tr>
<td>9/28</td>
<td>Crystal Structure</td>
<td>4</td>
<td>10/8</td>
<td>Isometric system</td>
</tr>
<tr>
<td>9/30</td>
<td>Halides</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/5</td>
<td>Crystallography</td>
<td>6,7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/7</td>
<td>Carbonates</td>
<td>17</td>
<td>10/29</td>
<td>Orthorombic system</td>
</tr>
<tr>
<td>10/12</td>
<td>*** EXAM***</td>
<td></td>
<td>Fall Recess</td>
<td>No lab</td>
</tr>
<tr>
<td>10/14</td>
<td>Sulfates</td>
<td>17</td>
<td>10/22</td>
<td>Tetragonal, hexagonal systems</td>
</tr>
<tr>
<td>10/19</td>
<td>Crystallography</td>
<td></td>
<td>10/26</td>
<td>Phosphates</td>
</tr>
<tr>
<td>10/21</td>
<td>*</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/26</td>
<td>Crystallography</td>
<td>6,7</td>
<td></td>
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<tr>
<td>10/28</td>
<td>Nesoisolicates</td>
<td>19</td>
<td>11/5</td>
<td>Monoclinic, triclinic systems</td>
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<tr>
<td>11/2</td>
<td>Crystallography</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/4</td>
<td>Soro/Cyclosilicates</td>
<td>19</td>
<td>11/12</td>
<td>Mineral analysis project</td>
</tr>
<tr>
<td>11/9</td>
<td>Crystallography</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/11</td>
<td>Isosilicates</td>
<td>19</td>
<td>11/19</td>
<td>X-ray diffraction I</td>
</tr>
<tr>
<td>11/16</td>
<td>X-ray crystallography</td>
<td>14</td>
<td>11/24</td>
<td>X-ray diffraction II</td>
</tr>
<tr>
<td>11/18</td>
<td>Phyllosilicates</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/23</td>
<td>X-ray crystallography</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/25</td>
<td>No Class or Lab – Thanksgiving Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/30</td>
<td>Hazardous Minerals</td>
<td></td>
<td>12/3</td>
<td>Refractive index measurement</td>
</tr>
<tr>
<td>12/2</td>
<td>Tectosilicates I</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
III. “Up Close and Mineral”

Each student will have an opportunity to research a mineral species. Do you have a favorite? One that has particular scientific or commercial value? A mineral that has an unusual occurrence or process of formation? Upon instructor approval, you will research a mineral and present your findings to the class. Guidelines to be distributed.

IV. Field Trip

A field trip to an internationally-known mineral collecting site will be held on a weekend day during the semester. Details to be announced.

V. Laboratory

Laboratory exercises will require your patience. Time is needed to train the eye to manipulate mineralogical models and other aids as well as the operation of several analytical instruments. Lab assignments will be due at the end of lab period unless otherwise stated. It is the responsibility of the student to make-up excused absences from lab and submit assignments within a week of the scheduled due date.

VI. Mineralogical Analysis Project

Each student will be required to perform a detailed mineralogical analysis of an unknown mineral. The final report will include a complete crystallographic description (crystal system, class, habit, form, etc), the results of determinative tests (density, chemical composition, crystal structure, optical properties, X-ray diffraction, etc), identification of the unknown, and supporting information from reference materials (classification, occurrence, associations, economic importance, etc). Project guidelines will be distributed.

VII. Grade-point distribution

<table>
<thead>
<tr>
<th>Grade-point distribution</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>lecture (60% of total):</td>
<td></td>
</tr>
<tr>
<td>midterm exam</td>
<td>100</td>
</tr>
<tr>
<td>final exam</td>
<td>100</td>
</tr>
<tr>
<td>problem sets</td>
<td>50</td>
</tr>
<tr>
<td>up close and mineral</td>
<td>50</td>
</tr>
<tr>
<td>mineralogical analyses project</td>
<td>100</td>
</tr>
<tr>
<td>weekly macro analyses 13@10</td>
<td>130</td>
</tr>
<tr>
<td>laboratory (40% of total):</td>
<td></td>
</tr>
<tr>
<td>lab exercises (14@25pts)</td>
<td>350</td>
</tr>
</tbody>
</table>

Final grade is based on 880 total points.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

25. Course Title: Petrology
26. Course Number: GEO 282

27. Course Credit Hours: 3
   Classroom Hours __2__  Lab Hours __3__  Other ______

28. Course Prerequisites: GEO 281

29. Course Description (as proposed for the Bulletin):

   A study of the identification, classification, composition, genesis, and alteration of igneous,
   sedimentary, and metamorphic rocks and their relation to crustal processes and tectonic
   environments. Two hours of lecture and three hours of lab per week. Offered every spring
   semester.

30. Required Documentation: Syllabus attached.
GEO 282 Petrology 3 credits

Lecture: 2 hrs/week  Laboratory: 3 hrs/week

Professor: Sid P. Halsor (sid.halsor@wilkes.edu)  Office Location: CSC 406A
Office Hours: M 11-12, W 2-3, F 9-10  Office Phone: 570-408-4611
Textbook: Raymond, Petrology: The Study of Igneous, Sedimentary, and Metamorphic Rocks, 2nd ed

I. Course Objectives

The study of rocks, their origin, distribution, description and classification, is what petrology is all about. To learn all there is to know about rocks in a single semester is an impossible task. In fact, many geology programs offer individual semester courses in igneous, sedimentary, and metamorphic petrology. Although this course will follow its broad title, time constraints will necessitate the treatment of select topics in each rock family.

GEO 282 has the following objectives:

1) To describe, classify, and explain the origin of the major types of igneous, sedimentary and metamorphic rocks.
2) To explain the geologic occurrences and field relations of the three rock families.
3) To discuss the relationships between rock-forming processes and plate tectonics.
4) To use a petrographic microscope to analyze optical properties of minerals in thin section and deduce processes/conditions related to formation.
5) To analyze petrographic and geochemical data from rock suites and use data to identify and model major rock-forming processes.

II. Schedule of Lecture and Lab Topics

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Text (chapters)</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 18/20</td>
<td>Mineralogy review/Intro:petrology and petrography</td>
<td>1</td>
<td>The Petrographic Microscope</td>
</tr>
<tr>
<td>Jan 25/27</td>
<td>Igneous rocks in the field-structure and texture</td>
<td>2</td>
<td>Optical properties of minerals I</td>
</tr>
<tr>
<td>Feb 1/3</td>
<td>Chemistry and classification of igneous rocks</td>
<td>3</td>
<td>Optical properties of minerals II</td>
</tr>
<tr>
<td>Feb 8/10</td>
<td>Phase rule and phase diagrams</td>
<td>4</td>
<td>Mineral ID in thin section</td>
</tr>
<tr>
<td>Feb 15/17</td>
<td>Origin of magmas</td>
<td>5</td>
<td>Mineral ID in thin section</td>
</tr>
<tr>
<td>Feb 22/24</td>
<td>Igneous rocks of convergent margins</td>
<td>7,9</td>
<td>Petrography of igneous rks I</td>
</tr>
<tr>
<td>Feb 29/2</td>
<td>Ig rocks of continental lithosphere/Exam#1</td>
<td>12</td>
<td>Petrography of igneous rks II</td>
</tr>
<tr>
<td>Mar 7/9</td>
<td>Spring Recess</td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td>Mar 14/16</td>
<td>Sed rocks in the field--structure and texture</td>
<td>14</td>
<td>Mineral ID in thin section</td>
</tr>
<tr>
<td>Mar 21/23</td>
<td>Composition and classification</td>
<td>15</td>
<td>Sedimentary petrography I</td>
</tr>
<tr>
<td>Mar 28/30</td>
<td>Holiday/Clastic rocks-shales and sandstones</td>
<td>18,19</td>
<td>Sedimentary petrography II</td>
</tr>
<tr>
<td>Apr 4/6</td>
<td>Carbonate rocks/Exam#2</td>
<td>21</td>
<td>Rocks of Pennsylvania</td>
</tr>
<tr>
<td>Apr 11/13</td>
<td>Met rocks in the field</td>
<td>23</td>
<td>Mineral ID in thin section</td>
</tr>
<tr>
<td>Apr 18/20</td>
<td>Structure and texture</td>
<td>23</td>
<td>Metamorphic petrography I</td>
</tr>
<tr>
<td>Apr 25/27</td>
<td>Regional metamorphism</td>
<td>27</td>
<td>Metamorphic petrography II</td>
</tr>
<tr>
<td>May 2</td>
<td>Regional metamorphism</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

IV. Petrology project

You are required to collect a fist-sized rock sample from an outcrop of a noteworthy formation or geologic locality. You will perform a petrologic analysis of your sample that includes a detailed petrographic-grade hand specimen description and analysis of a thin section you construct from your sample.
Results of your petrologic analysis are to be integrated in a report that includes supporting geologic information (geologic location and significance of occurrence, geologic and tectonic setting, petrology (reported and observed) and conclusions. Your results should support, or perhaps contradict, the current petrologic understanding of the body of rock represented by your specimen.

IV. Field Trip
A field trip will be held on a weekend day in April. Date and destination to be announced.

V. Grade-Point Distribution
Final grade is based on 700 points possible.

<table>
<thead>
<tr>
<th></th>
<th>Lecture (60% of total)</th>
<th>Laboratory (40% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 exams @ 100</td>
<td>200</td>
<td>lab assignments 200</td>
</tr>
<tr>
<td>final exam</td>
<td>100</td>
<td>petrologic project 100</td>
</tr>
<tr>
<td>4 exercises @ 25 pts</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Wilkes University Curriculum Committee
COURSE ADDITION FORM

31. Course Title: Stratigraphy and Sedimentation

32. Course Number: GEO 345

33. Course Credit Hours: 3
   Classroom Hours: 2
   Lab Hours: 3
   Other: 

34. Course Prerequisites: GEO 211

35. Course Description (as proposed for the Bulletin):

The study of the formation and interpretation of sedimentary systems, from sediment grains to depositional basins. The course starts from the grain scale and moves up to basin and global scales. Two hours of lecture and three hours of lab per week. Pre-requisites: GEO 211 and GEO 212. Offered every fall semester.

36. Required Documentation: Syllabus attached
GEO 345  **Stratigraphy and Sedimentation** 3 credits

Lecture: 2hrs/week  
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2016)  
Office Location:  
Office Hours:  
e-mail:  
Office Phone:  


I. Description

This course covers the origin, classification, distribution, and correlation of sedimentary rock bodies and their use in interpreting geological history. This course will provide a broad overview of the processes involved in the production of sedimentary rock bodies and the formation of stratigraphic successions, the classification of sedimentary rocks and rock bodies, the recognition of ancient depositional environments, and the methods and uses of stratigraphic (basin) analyses.

II. Objectives

1) Develop a working knowledge of formal rock classification schemes  
2) Recognize common sedimentary rock structures and understand their origins  
3) Be able to make detailed descriptions of sedimentary rocks and rock bodies  
4) Develop a working knowledge of basic sedimentological concepts, including facies, facies assemblages, depositional environments, depositional systems, systems tracts, vertical successions, and stacking patterns  
5) Recognize common depositional environments and systems as preserved in the rock record  
6) Develop a familiarity and understanding of the stratigraphic code  
7) Develop a thorough understanding of more commonly used stratigraphic units  
8) Develop a basic understanding of the principles of sequence stratigraphy  
9) Be able to conduct regional stratigraphic correlations based on outcrop or subsurface data  
10) Understand basic stratigraphic principles associated with base-level fluctuation, sediment supply, and the development of accommodation space  

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

37. Course Title: Structure and Tectonics

38. Course Number: GEO 349

39. Course Credit Hours: 3
   Classroom Hours___2___   Lab Hours___3___   Other_____

40. Course Prerequisites: GEO 281 and GEO 282

41. Course Description (as proposed for the Bulletin):

   The study of rock deformational processes and resulting structures in the Earth's crust with
   application to global and regional tectonics. Lab work and field trips emphasize the use of methods
   to assist in the geometric and kinematic interpretation of rock structures. Two hours of lecture and
   three hours of lab per week. Pre-requisites: GEO 281 and GEO 282. Course offered every fall
   semester.

42. Required Documentation: Syllabus attached
GEO 345 Structure and Tectonics 3 credits

Lecture: 2hrs/week
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2017)  
Office Location:  
Office Hours:  
e-mail:  
Office Phone:  


I. Description
This course is an introduction to common structural features - folds, faults, foliations, lineations, unconformities, geologic contacts – and their geometry and origin. Examination of basic concepts of stress and strain; laboratory application of basic geometric techniques used in structural analysis, including orthographic and stereographic projection, construction of cross-sections, and interpretation of structure from geological maps. The development of global plate tectonics is covered and related to the processes that drive the formation of geologic structures.

II. Objectives

1) Accurately describe plate boundaries and orogenic belts  
2) Develop the ability to think in 3-dimensions  
3) Analyze geologic structures using maps and cross-sections  
4) Use orthographic projections, trigonometric equations and stereonets to represent 3D figures in 2D space and to solve structural problems  
5) Develop a working knowledge of rock mechanics and the use of stress-strain diagrams  
6) Be able to interpret the conditions under which rock will fold, fault or fracture  
7) Be able to identify mesoscopic and microscopic structures in rock  
8) Be able to explain structural features in the context of tectonic forces  
9) Gain proficiency in the use of a Brunton compass  
10) Be able to write a structural history, combining observations from geologic maps, interpretations from cross-sections and relying on cross-cutting relationships and relative age constraints

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

43. Course Title:  Paleoeclimatology

44. Course Number:  GEO 351

45. Course Credit Hours:  3
   Classroom Hours 2 ___  Lab Hours  3 ___  Other ______

46. Course Prerequisites:  GEO 211

47. Course Description (as proposed for the Bulletin):

The goal of this course is to present an overview of the methods used to reconstruct the earth’s climate history and the techniques used to determine the timing of environmental changes. Paleoeclimatic data from proxy records, such as ice cores or tree rings, provides a longer perspective on climatic variability than is possible from instrumental or historical records. Particular emphasis will be given to the natural controls on Earth’s climate across a variety of timescales, including plate tectonic, orbital, millennial, to centennial and sub-decadal variations. The course will focus on the climatic changes during the late Cenozoic – the time of the ice ages. Topics to be discussed will include: paleoeclimatic reconstruction, climate and climatic variation, dating methods, ice cores, marine and lake sediments, corals, speleothems, soils, pollen, dendrochronology, documentary data, and paleoclimate models.

48. Required Documentation:  Syllabus attached
GEO 351 Paleoclimatology 3 credits

Lecture: 2hrs/week
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2016)  Office Location:  
Office Hours:  
e-mail:  
Office Phone:  


I. Description

The goal of this course is to present an overview of the methods used to reconstruct the earth’s climate history and the techniques used to determine the timing of environmental changes. Paleoclimate data from proxy records, such as ice cores or tree rings, provides a longer perspective on climatic variability than is possible from instrumental or historical records. Particular emphasis will be given to the natural controls on Earth’s climate across a variety of timescales, including plate tectonic, orbital, millennial, to centennial and sub-decadal variations. The course will focus on the climatic changes during the late Cenozoic – the time of the ice ages. Topics to be discussed will include: paleoclimatic reconstruction, climate and climatic variation, dating methods, ice cores, marine and lake sediments, corals, speleothems, soils, pollen, dendrochronology, documentary data, and paleoclimate models.

II. Objectives

1) Be able to identify climate forcings and responses.
2) Discuss the various components of Earth’s climate system, such as the cryosphere, atmosphere, biosphere, and hydrosphere.
3) Develop a mechanistic understanding of complex component interactions and have the ability to map out both negative and positive feedback loops.
4) Investigate the variable time scales upon which different climate processes occur and understands as residence time, and periodicity.
5) Discuss tools and techniques used to interpret changes in Earth’s climate through geologic time.
6) Recognize and critique modern paleoclimate studies through the use of primary literature in climate science.

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our
existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.

Wilkes University Curriculum Committee
COURSE ADDITION FORM

49. Course Title: Hydrogeology

50. Course Number: GEO 352

51. Course Credit Hours: 3
   Classroom Hours ___2___   Lab Hours ___3___   Other ______

52. Course Prerequisites: GEO 211

53. Course Description (as proposed for the Bulletin):

An introduction to the study of groundwater: groundwater flow, well hydraulics, groundwater quality and pollution, and resource exploration, evaluation, and management. Lab activities use a mix of field, wet lab, computer and mapping skills. Two hours of lecture and three hours of lab per week. Pre-requisite: GEO 211

54. Required Documentation: Syllabus attached
GEO 352  **Hydrogeology** 3 credits

Lecture: 2hrs/week  
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2016)  
Office Location:  
Office Hours:  
e-mail:  


I. Description

Hydrogeology encompasses the relationship between geologic materials and the process of water movement within the Earth. This course will focus on understanding of the hydrological cycle and processes, geologic framework and groundwater occurrence, principles of subsurface water movement, methods of mapping and developing/managing groundwater, principles of aqueous geochemistry, and approaches for characterization of water types as well as transport of contaminant in groundwater. The course includes practical methods of laboratory water quality testing, groundwater flow analysis and resource evaluation. Mathematical models are used to characterize groundwater flow in natural media.

II. Objectives

1) Quantitatively examine the processes of the hydrologic cycle  
2) Assess basic water chemical and physical properties  
3) Distinguish between confined and unconfined aquifers from data  
4) Determine denudation rates and sedimentary loads in watersheds  
5) Apply Darcy’s Law to groundwater flow and geological material interpretation  
6) Use and interpret pumping data for groundwater flow applications  
7) Plot and interpret standard diagrams (Ternary, Piper, Stiff, etc) for water quality analysis  
8) Use proper sampling and water analytical techniques for water quality analysis  
9) Conduct a groundwater investigation at a field site and use monitoring wells for sample collecting, flow direction and recharge rate.

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee

COURSE ADDITION FORM

55. Course Title: Introduction to Paleontology

56. Course Number: GEO 365

57. Course Credit Hours: 3
   Classroom Hours: 2   Lab Hours: 3
   Other:

58. Course Prerequisites: GEO 211, GEO 212

59. Course Description (as proposed for the Bulletin):

This course examines the history of life on Earth as reflected in the fossil record. The course covers the oldest known forms of life from over three billion years ago through the origin of marine communities, the invasion of land, dinosaurs, and the age of mammals. Emphasis will be placed on common fossil groups and the interaction of organisms with their diverse environments. Two hours of lecture and three hours of lab per week. Pre-requisites: GEO 211 and GEO 212

60. Required Documentation: Syllabus attached
GEO 365  **Introduction to Paleontology** 3 credits

Lecture: 2hrs/week  
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2016)  
Office Location:  
e-mail:  
Office Hours:  
Office Phone:  

Example Textbook: *Principles of Paleontology*, 3rd ed. by Foote and Miller, 2007

I. **Description**

Geology began as a science with the study of fossils. Fossils are the basis for establishing global correlation among Phanerozoic rocks, and thus are critical to the reconstruction of the past 550 million years of earth history. This course examines the history of life on Earth as reflected in the fossil record. The course covers the oldest known forms of life from over three billion years ago through the origin of marine communities, the invasion of land, dinosaurs, and the age of mammals. Emphasis will be placed on common fossil groups and the interaction of organisms with their diverse environments.

II. **Objectives**

1) Be able to read the title and abstract of an article in a professional paleontological journal and have a general understanding of what it is about, even if the details are too technical.  
2) Be able to explain the biases and limitations of paleontological data.  
3) Be able to recognize the characteristics of the major phyla and classes of invertebrate animals, and know where to find information about them.  
4) Be able to explain how fossils are used in establishing geologic age of rocks, correlating strata, and reconstructing paleoenvironments.  
5) Be able to explain how a fossil species is recognized, formally described, and classified into higher taxonomic categories.  
6) Be able to describe the sources of variation in morphology of a species.  
7) Be able to explain the theory of evolution and how the fossil record supports it.  
8) Plot and interpret standard diagrams (Ternary, Piper, Stiff, etc) for water quality analysis

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

61. Course Title: Geomorphology

62. Course Number: GEO 370

63. Course Credit Hours: 3
   Classroom Hours__2____   Lab Hours__3____   Other_______

64. Course Prerequisites: GEO 211

65. Course Description (as proposed for the Bulletin):

   Land forms, their evolution, and the human role in changing the surface of the earth, utilization of
geologic and hydrologic information, and field investigations. Two hours of lecture and three hours
of lab per week.

66. Required Documentation: Syllabus attached
GES 370 Geomorphology Syllabus
Lecture: 2 hrs/week; Lab: 3hrs/week

Instructor: Dr. Brian Redmond  Department of Environmental Engr & Earth Science
Office: 426 CSC  Telephone: (570) 408-4698
  e-mail: brian.redmond@wilkes.edu
  Home: 99 Shaver Avenue, Shavertown, PA 18708  Telephone: 696-2906
  Office hrs:  MW 3 - 4 PM, 5:20 - 6:20 PM;  T 4 - 5 PM

  Lecture:  A  MW  5 - 6:50 PM  CSC 227
  Laboratory:  L1  R  1 - 3:50 PM  CSC 227

Text: A useful but not required text is *Geomorphology*, 1998, Third edition, Arthur L. Bloom, Waveland Press, Inc. which can likely be ordered on-line if desired. An extensive and amplified lecture note outline is available on the course website.

Lecture and Lab Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Text</th>
<th>Chapter</th>
<th>Lab Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>The Scope of Geomorphology</td>
<td>Continental Height vs Area</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Energy Flow in Geomorphic Systems</td>
<td></td>
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<tr>
<td>2</td>
<td>3</td>
<td>Cenozoic Tectonism</td>
<td>Isostasy</td>
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<tr>
<td>3</td>
<td>4</td>
<td>Cenozoic Climate Change</td>
<td>Topography and Structure</td>
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<tr>
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<td>5</td>
<td>Tectonic Landforms</td>
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<tr>
<td>4</td>
<td>6</td>
<td>Volcanoes</td>
<td>Soils</td>
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<td>5</td>
<td>7</td>
<td>Rock Weathering</td>
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<td>6</td>
<td>8</td>
<td>Exam 1</td>
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<tr>
<td>7</td>
<td>9</td>
<td>Karst and Speleology</td>
<td>Karst</td>
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<tr>
<td>8</td>
<td>10</td>
<td>Mass Wasting and Hill slopes</td>
<td>Erosion and Sedimentation</td>
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<td>11</td>
<td>The Fluvial Geomorphic System</td>
<td>Channel Characteristic I</td>
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<td>12</td>
<td>Evolution of the Fluvial System</td>
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<tr>
<td>9</td>
<td>13</td>
<td>Structural Control of Fluvial Erosion</td>
<td>Channel Characteristics II</td>
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<td>14</td>
<td>Arid &amp; Savanna Landscapes; Eolian Processes &amp; Landforms</td>
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<td>15</td>
<td>Periglacial Geomorphology</td>
<td>Exam 2</td>
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<td>16</td>
<td>Arid Landforms</td>
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<td>17</td>
<td>Glaciers as Landforms: Glaciology</td>
<td>Glacial Landforms</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Glacial Geomorphology</td>
<td></td>
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</tbody>
</table>
Wilkes University Bulletin Description: GES 370 Geomorphology (three credits)

Landforms, their evolution, and the human role in changing the surface of the earth, utilization of geologic and hydrologic information, and field investigations. Two hours lecture and three hours laboratory. Fee: $45. Prerequisites: GES 211 and ENV 321.

**Course Objectives**

1. To be able to recognize that certain data are missing (not given) in a particular assigned problem and to be able to find that missing data previously given earlier in the course.
2. To be able to recognize that there is extraneous data given in a problem and to be able to ignore that irrelevant data in the solution of the assigned problem.
3. To be able to describe how the processes driven by the internal energy of the Earth, exemplified by Plate Tectonics and hot spot activity, and the processes driven directly or indirectly by solar energy including erosion/sedimentation, weathering, and mass wasting have shaped the surface of the Earth, both land and water.
4. To describe in detail all of the elements of the hydrologic cycle and how the cycle influences the surface of the Earth.
5. To explain how the Earth's surface originated and changed through geologic time as a consequence of a dynamic interaction between the forces driven by the internal energy of the Earth and solar energy.
6. To describe stratigraphic principles and their use in the interpretation of earth and life history.
7. To examine in detail the specific surface-shaping forces and their consequences including: tectonic landforms, volcanism, fluvial mechanics, eolian and glacial processes, and coastal dynamics.
8. To recognize and be able to describe how humans impact the surface of the Earth and are, in their turn, affected by surficial processes.
9. To be able to use maps, charts, and models (recognize patterns) in the solution of geomorphic problems.

**Course Policies**

There will be three open-book exams, mostly noncomprehensive, the last exam being held during Finals. The three exams will count 25% each of the final grade, the remaining 25% consisting of lab quizzes based on the lab exercises and field assignments. All labs will be provided
by the instructor. Lab sections for the 5th and 10th weeks will not be held; they will be replaced by the exams. Field trips will be at the mercy of the weather and may replace some lab exercises. All exams, quizzes, and labs are open book/notes but not open neighbor. There may be different versions of the exams, quizzes, and labs.

As an upper level class, information that has already been given (data such as the density of seawater) many not be given again even though it might be needed to answer another lab or exam question; the student is expected to be able to recognize that this information is necessary to answer the problem and be able to find it in the textbook, notes, or lab work as necessary. Also, in keeping with the modern problem of too much extraneous information, irrelevant information may be given in a lab or exam problem; the student is expected to be able to ignore this irrelevant information (a necessary modern skill).
Wilkes University Curriculum Committee
COURSE ADDITION FORM

67. Course Title: Geologic Hazards

68. Course Number: GEO 375

69. Course Credit Hours: 3
   Classroom Hours__3__  Lab Hours__  Other:

70. Course Prerequisites: GEO 211

71. Course Description (as proposed for the Bulletin):

This course examines geologic processes that are a natural consequence of plate tectonics and hazardous to life and property. After establishing a framework for geologic hazards study, principle geologic hazards will be investigated. Emphasis will be placed on current scientific understanding, event frequency, forecasting and monitoring and mitigation. Several case studies will be included. Three hours of lecture per week. Prerequisite GEO 211

72. Required Documentation: Syllabus attached
GEO 375 Geological Hazards 3 credits

Lecture: 3 hrs per week

Professor: Dr. Sid P. Halsor (sid.halsor@wilkes.edu) Office: CSC 406A
Office Hours: T 1-2, W 10-11, R 3-4 (and by appointment) Phone: 408-4611
Course Web Page: https://live.wilkes.edu or via “My Courses” within Wilkes portal

I. Course Overview

Earth is a unique planetary body in the solar system and perhaps in the galaxy and beyond. Although life as we know it is certainly the most notable distinguishing feature, the origin and evolution of life are inextricably linked to the dynamic nature of Earth. Central to earth dynamics is global plate tectonics. Without plate tectonics, and the appropriate amount of heat flow to sustain it, earth’s surface would surely be desolate, harsh and subject to extreme temperature variations. Plate tectonic processes have continuously shaped the earth’s surface while playing a vital role in moderating climate and regulating geochemical cycles—key for earth’s place in the “habitable zone”.

The downside to a dynamic world with an active, integrated plate tectonic system is the natural, periodic, sudden release of energy in the form of volcanic eruptions, earthquakes, landslides and flash floods. Each year on a global scale, these geologic hazards are responsible for enormous costs both in terms of property and life.

This course examines geologic processes that are a natural consequence of plate tectonics and hazardous to life and property. After establishing a framework for geologic hazards study, principle geologic hazards will be investigated. Emphasis will be placed on current scientific understanding, event frequency, forecasting and monitoring and mitigation. Several case studies will be included. In addition to entry-level content in the textbook, subject resources will include carefully selected technical articles.

II. Course Objectives

1) To discuss the implications for life on a dynamic vs. static planetary system.
2) To explain the difference between hazard and risk and the methods used for risk assessment.
3) To distinguish between natural occurring and human-driven geologic hazards.
4) To explain the frequency of sudden geologic events on spatial scales that range between billions and tens of years.
5) To discuss the geologic context of geologic hazards and their triggering mechanisms.
6) To explain the difference between a prediction and a forecast, and the methods that scientists use to determine the occurrence of a hazard event.
7) To explain how scientist and engineers mitigate the effects of a geologic hazard.
8) To discuss the general worldwide distribution patterns of geologic hazards.

III. Schedule of Lecture and Lab Topics/Exams

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 25-29</td>
<td>Intro to geologic hazards/human toll/frequency</td>
<td>1</td>
</tr>
<tr>
<td>Sep 3-5</td>
<td>Geologic hazards and the plate tectonic model</td>
<td>2</td>
</tr>
<tr>
<td>Sep 8-12</td>
<td>Seismic energy and rock mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Sep 15-19</td>
<td>Earthquake monitoring, forecasting and mitigation</td>
<td>4</td>
</tr>
<tr>
<td>Sep 24-26</td>
<td>Secondary effects of earthquakes</td>
<td>5</td>
</tr>
<tr>
<td>Sep 29-3</td>
<td>Exam/Styles of volcanic eruptions</td>
<td>6</td>
</tr>
<tr>
<td>Oct 6-8</td>
<td>Tectonic setting, volcano types and eruptive products</td>
<td>6</td>
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</tbody>
</table>
IV. Course Project

Each student will complete a course project involving a written report and an oral presentation. Guidelines for the course project will be distributed in class.

V. Grade-Point Distribution

<table>
<thead>
<tr>
<th>Points</th>
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<tbody>
<tr>
<td>Lecture (60% of total):</td>
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<tr>
<td>2 midterm exams @ 100 pts</td>
<td>200</td>
</tr>
<tr>
<td>In-class discussion</td>
<td>100</td>
</tr>
<tr>
<td>1 final exam</td>
<td>100</td>
</tr>
<tr>
<td>Course project</td>
<td>100</td>
</tr>
<tr>
<td>Geomapper exercises</td>
<td>200</td>
</tr>
<tr>
<td>Total (basis for final grade)</td>
<td>700</td>
</tr>
</tbody>
</table>
73. Course Title:  Geology Field Camp

74. Course Number:  GEO 380

75. Course Credit Hours:  4
   Classroom Hours_____  Lab Hours_____  Other:
4-week field course

76. Course Prerequisites:  GEO 281, GEO 282, GEO 345, GEO 349 and GEO 352

77. Course Description (as proposed for the Bulletin):

A four-week summer field course designed to train students in traditional and modern methods of geologic investigations. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections and construct geologic maps and cross sections. Field locations may range from local/regional to western U.S. depending on course emphasis and resources. Pre-requisites: GEO 281, GEO 282, GEO 345, GEO 349 and GEO 352. Offered every summer.

78. Required Documentation:  Syllabus attached
GEO 380  Geology Field Camp 4 credits

4 week summer course

Professor: new faculty hire (fall 2017)  Office Location:
Office Hours:  Office Phone:
e-mail:


I. Description

The summer Geology Field Camp is a 4-week (20 instructional days) field course focused on field mapping and data collection in local, regional or national geologic settings. Emphasis will vary depending on the field camp location. Students will learn time-tested field methods and an introduction to digital mapping and data collection techniques. Students will learn geologic map-making and professional report preparation through problem-based field exercises.

II. Objectives

1) Reinforce geologic concepts delivered in the classroom setting; put theory into practice
2) Make field observations concerning regional geology, including changes in
   sedimentary facies, structural deformation, tectonics and geologic history
3) Demonstrate the value of note-taking, sketches and measurement records in the field
2) Describe and log stratigraphic sequences of sedimentary rocks
3) Integrate aerial photographs, GIS and GPS in mapping projects
3) Construct geologic maps and cross-sections of areas comprising several square miles.
3) Draft a written report of mapping project that includes an interpretation of geologic field
   relationships.

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in
accordance with section 6.3.4 of the Faculty Handbook. Assessment measures will likely include
field notebook content, methods training and project reports.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

79. Course Title: Geochemistry

80. Course Number: GEO 383

81. Course Credit Hours: 3
   Classroom Hours: 2
   Lab Hours: 3

82. Course Prerequisites: CHM 115/113, CHM 116/114, GEO 211, GEO 281 and GEO 282

83. Course Description (as proposed for the Bulletin):

Application of chemistry to study the distribution and cycling of elements in the crust of the earth. Includes chemical bonding and crystallization, phase rules and phase diagrams, chemical equilibria, radiogenic and stable isotopes and origin of elements. Geochemical environments of study include low-temperature aqueous solutions and high-temperature magmatic systems. Two hours of lecture and three hours of lab per week. Prerequisites: CHM 115/113, CHM 116/114, GEO 211, GEO 281, GEO 282

84. Required Documentation: Syllabus attached
GEO 383  Geochemistry 3 credits

Lecture: 2hrs/week  Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2016)  Office Location:
Office Hours:  Office Phone:
e-mail:


I. Description

This course focuses on the chemistry of the natural world and the chemical evolution of the Earth over geologic time. Applications of chemistry are used to study the distribution and cycling of elements in the crust of the earth. Important concepts include chemical bonding and crystallization, phase rules and phase diagrams, chemical equilibria, radiogenic and stable isotopes and origin of elements. Geochemical environments of study include low-temperature aqueous solutions and high-temperature magmatic and metamorphic systems.

II. Objectives

1) To broadly understand the physical-chemical principles at the atomic and molecular level that form the basis for most geologic processes
2) To understand the chemical interactions between and among the “spheres” of the earth including anthropogenic impacts
3) To use geochemical principles in concrete ways to predict the spontaneity of geologically relevant chemical reactions then relate those predictions to reality
4) To gain a working knowledge of analytical instrumentation relevant to the chemical and mineralogical analysis of geologic materials including the theory, sample preparation, operation, collection, and limitations of such instrumentation.
5) To interpret geochemical data and use it in rigor ways to test hypotheses.
6) To engage in a geochemical research project involving the field collection of geological samples for geochemical analysis, use of analytical instrumentation for data collection, and the statistical analysis of derived data

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

85. Course Title: Applied Geophysics

86. Course Number: GEO 390

87. Course Credit Hours: 3
   Classroom Hours: 2
   Lab Hours: 3

88. Course Prerequisites: PHY 171, PHY 174, GEO 211

89. Course Description (as proposed for the Bulletin):

An introduction to the application of geophysical methods to geological and environmental investigations. Topics include fundamentals of geophysics and hands-on instrument training and measurement. Instruments may include ground penetrating radar, seismic reflection and refraction, electrical resistivity and electromagnetic induction. Two hours of lecture and three hours of lab per week. Pre-requisites: PHY 171, PYH 174, GEO 211

90. Required Documentation: Syllabus attached

50
GEO 390  **Applied Geophysics**  3 credits

Lecture: 2hrs/week  
Laboratory: 3 hrs/week

Professor: new faculty hire (fall 2017)  
Office Location:  
e-mail:  
Office Phone:  
Office Location:  
Office Phone:  


**I. Description**

Most of what is known about the Earth’s interior is derived from geophysics, the branch of geology that deals with the physics of the Earth. Geophysics is the primary tool for exploration in the oil and mining industries, and it is also widely used to characterize the subsurface for environmental, engineering and hydrologic investigations. This course introduces the field of geophysics and several of its industrial and geoscience/engineering applications. Topics include fundamentals of geophysics and hands-on instrument training and measurement. Instruments will include a subset of the following: ground penetrating radar, seismic reflection and refraction, electrical resistivity, electromagnetic induction and gravity.

**II. Objectives**

1) Be able to explain the value of geophysics to the science of the earth  
2) Use knowledge to articulate the fundamental principles behind a range of geophysical methods  
3) Connect measurable physical properties with geologic structure, stratigraphy, hydrogeology and subsurface features such as voids or tunnels and buried objects  
4) Make informed choice of which method to use and conduct a geophysical survey  
5) Perform data collection, processing and interpretation  
6) Develop critical thinking skills and be able to articulate limitations of geophysical methods

Schedule of topics, assessment and pertinent policies to be determined by new faculty member in accordance with section 6.3.4 of the Faculty Handbook. Common assessment measures in our existing program courses include exams and quizzes, project reports and presentations, homework problems and lab exercises.
Wilkes University Curriculum Committee
COURSE ADDITION FORM

91. Course Title: Senior Projects I

92. Course Number: GEO 391

93. Course Credit Hours: 1
   Classroom Hours: 1
   Lab Hours: ______
   Other: ______

94. Course Prerequisites: Department permission

95. Course Description (as proposed for the Bulletin):

   Design and development of selected research projects in geology under the direction of a faculty
   member. Capstone research deliverables include a proposal, detailed progress reports and a
   formal mid-year report. Requirements: Senior standing in Geology and department permission.
   (See the department for more details about the department permission.) Offered every Fall
   semester.

96. Required Documentation: Syllabus attached.
I. Course Overview
This course is the first of two successive courses in our capstone senior research experience for earth & environmental science majors. Students enter this course having defined their research topic and team, and have completed their literature review and project proposal documents (as required by this course’s pre-requisite course, EES 302). Working closely under the supervision of a research advisor(s), students review and advance their proposals while conducting their research. Periodic class meetings will be used to insure satisfactory progress and provide opportunities for group discussion of the research process, including methods, data acquisition and analysis, and both written and oral presentation. Course activities include two practice oral presentations and two drafts of project proposal. A final oral presentation and a final proposal are required for the successful completion of this course.

II. Catalog Description
Design and development of selected research projects in geology under the direction of a faculty member. Capstone research deliverables include a proposal, detailed progress reports and a formal mid-year report. Requirements: Senior standing in Geology and department permission. (See the department for more details about the department permission.) Offered every Fall semester.

III. Course Objectives
1. Apply the basic concepts of geology and mathematics to analyze and/or solve problems specific to their field
2. Locate and use professional articles in order to investigate a geologic problem
3. Design and conduct experiments to gather data for analysis and interpretation
4. Communicate project content using both oral and written techniques
5. Function as a team to complete research project
6. Evaluate the societal and geologic impact of project recommendations using standard ethical principles (if applicable)

IV. Course Rules
1. All reports, proposal drafts and the final proposal are due when indicated. The project proposal drafts and final proposal must comply with the required format to receive full credit.
2. Deadlines and adherence to deadlines will be a key component of the grade for your proposal drafts and materials.
2. Attendance, progress and occasional memos that are part of weekly meetings will account for 10% of your final grade.
3. Group members will be individually evaluated for all their work during the semester. Your advisor will provide a grade, your instructor will provide a grade and your group partners will be asked to provide an assessment of your work. You will be individually evaluated during oral presentations including Q & A.

4. Students must attend each scheduled course meeting time unless a dire emergency prevents them from attending and they have been excused.

5. The student must participate in class or meeting discussions to received full credit for "participation".

**Communication:**

1. I should be copied on all emails relevant to the course to be sure you are meeting relevant deadlines. Always use my wilkes email: sid.halsor@wilkes.edu.

2. Jen Fela should receive emails for the drafts as outlined in the schedule of events. Her email address is felaja@msn.com. Please use an appropriate message in the email that you send to Jen since she is our external editor. The message should include a salutation and a description of the information attached and what you request from her.

3. Your faculty advisor should also be copied on all messages relevant to the course.

**Grading System:**

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<th>Component</th>
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<tr>
<td>Proposal Drafts (2)</td>
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<tr>
<td>Proposal/Progress Presentations (2)</td>
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<td>Attendance and Discussion at weekly group meetings</td>
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<td>Final Proposal</td>
<td>20%</td>
</tr>
<tr>
<td>Final Presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Attendance and Participation in group events</td>
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</tr>
<tr>
<td>Project Advisor Grade</td>
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**Grade:**

- >90% 4.0
- 85-89.99% 3.5
- 80-84.99% 3.0
- 75-79.99% 2.5
- 70-74.99% 2.0
- 65-69.99% 1.5
- 60-64.99% 1.0
97. Course Title: Senior Projects II

98. Course Number: GEO 392

99. Course Credit Hours: 2
   Classroom Hours  __2__  Lab Hours _______  Other _______

100. Course Prerequisites:

101. Course Description (as proposed for the Bulletin):

   Second semester continuation of Senior Projects I. Capstone research deliverables include detailed progress reports, a professional-grade poster, a final written report, and a formal oral presentation of research project. Requirements: Senior standing in Geology and department permission. (See the department for more details about the department permission.) Pre-requisite: GEO 391. Offered every Spring semester.

102. Required Documentation: Syllabus attached.
WILKES UNIVERSITY
Department of Environmental Engineering and Earth Sciences
Senior Projects II - GEO 392

Instructor: Sid Halsor (CSC 417)
Contact: Telephone: Ext. 4611  Fax: 408-7865  e-mail: sid.halsor@wilkes.edu
Office Hours: M 11 – 12, W 2-3, & F 9-10 or by appointment

Meeting Times:
Thursday Weekly Meetings: CSC 119 4-5 pm  (alternative: Friday 3-4pm)
Individual Group Meetings: to be scheduled

Practice Presentations: Friday 3 p.m.  April 10th; Friday 3 p.m. April 24th CSC 102

Final Presentation:
• Thursday, April 30th in the SUB Ballroom Room. Time TBD.

Catalog Description

GEO 392: Second semester continuation of Senior Projects I. Capstone research deliverables include detailed progress reports, a professional-grade poster, a final written report, and a formal oral presentation of research project. Requirements: Senior standing in Geology and department permission. Pre-requisite: GEO 391

Course Objectives

1. Students will apply the basic concepts of geology and mathematics to analyze and/or solve problems specific to their field
2. Students will be able to locate and use professional articles in order to investigate an environmental issue
3. Students will design and conduct experiments to gather data for analysis and interpretation
4. Students will be able to communicate using both oral and written techniques
5. Students will function as a team to complete their project
6. Students will evaluate the impact of their project recommendations to society and the science of geology using standard ethical principles if applicable
7. Students will develop project management skills to establish deadlines and facilitate the completion of their project.

Course Rules:

1. All report drafts and the final report are due when indicated unless the group members consult with me to change the due date. Do not expect me to automatically change a due date—you must
have a compelling reason to receive a due date extension. Late assignments will receive a
maximum of 50% of the possible points. **Deadlines and adherence to deadlines will be a key component of the grade for your written drafts.**

2. The project report drafts and final report must comply with the required format to receive full credit.

3. Group members will be individually evaluated during oral presentations including Q & A.

4. The students must attend each scheduled course meeting time unless previously excused to receive full credit for "attendance".

5. The student must participate in class discussions to received full credit for "participation".

**Grading System:**

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<tbody>
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<td>Report Drafts (2)</td>
<td>6% each</td>
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<tr>
<td>Practice Presentations (2)</td>
<td>6% each</td>
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<tr>
<td>Project Poster</td>
<td>10%</td>
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<tr>
<td>Final Report</td>
<td>20%</td>
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<tr>
<td>Final Presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Attendance and Participation</td>
<td>6%</td>
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<td>Project Advisor Grade</td>
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**Guaranteed Grade:**

<table>
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<tr>
<th>Percentage Range</th>
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<td>60-64.99%</td>
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</table>
8. Signatures and Recommendations. (please date)
   - Signatures of involved Department chair(s) and Dean(s) indicate agreement with the proposal and that adequate resources (library, faculty, technology) are available to support proposal.
   - If a potential signatory disagrees with a proposal he/she should write “I disagree with this proposal” and a signed statement should be attached to this submission.

<table>
<thead>
<tr>
<th>Print Name/Title</th>
<th>Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>Department chair(s) of all potentially affected programs</td>
<td></td>
<td>4-11-16</td>
</tr>
<tr>
<td>William B Hudson</td>
<td>Wal Bethea</td>
<td>4-11-2016</td>
</tr>
<tr>
<td>Susan Hitzak</td>
<td>Susan Hitzak</td>
<td>4-11-2016</td>
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<tr>
<td>Print Name/Title</td>
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<td>Date</td>
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<tr>
<td>Registrar</td>
<td></td>
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<tr>
<td>Pending Final APC approval</td>
<td></td>
<td>4-11-2016</td>
</tr>
<tr>
<td>Print Name/Title</td>
<td>Signature</td>
<td>Date</td>
</tr>
<tr>
<td>Provost (For new programs, significant revisions and revisions to the General Education Program revisions only).</td>
<td></td>
<td>4-11-2016</td>
</tr>
<tr>
<td>Provost should check here if this proposal is a program revision AND the significance of the revision requires review and approval by APC prior to Curriculum Committee.</td>
<td></td>
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<tr>
<td>Jeffrey A. Stratford</td>
<td></td>
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<tr>
<td>Print Name/Title</td>
<td>Signature</td>
<td>Date</td>
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<tr>
<td>Chair, Academic Planning Committee. For new programs, program revisions sent via the provost. Signature indicates that the proposal has been reviewed and approved by APC.</td>
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<td>4-11-2016</td>
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<tr>
<td>Print Name/Title</td>
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<tr>
<td>Chair, General Education Committee. For revisions to General Education program only. (Signature indicates that the proposal has been approved by GEC).</td>
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<td>4-11-2016</td>
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